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SCIENTIFIC-TECHNICAL CONFERENCE ON THE STATIC AND DYNAMIC STRENGTH OF ENGINES. QUESTIONS OF THE STRENGTH OF ENGINES.

by

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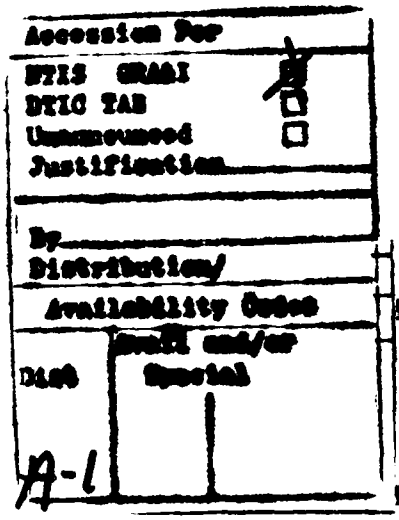

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Block	Italic	Transliteration	Block	Italic	Transliteration
А а	*А а*	A, a	Р р	*Р р*	R, r
Б б	*Б б*	B, b	С с	*С с*	S, s
В в	*В в*	V, v	Т т	*Т т*	T, t
Г г	*Г г*	G, g	У у	*У у*	U, u
Д д	*Д д*	D, d	Ф ф	*Ф ф*	F, f
Е е	*Е е*	Ye, ye; E, e*	Х х	*Х х*	Kh, kh
Ж ж	*Ж ж*	Zh, zh	Ц ц	*Ц ц*	Ts, ts
З з	*З з*	Z, z	Ч ч	*Ч ч*	Ch, ch
И и	*И и*	I, i	Ш ш	*Ш ш*	Sh, sh
Й й	*Й й*	Y, y	Щ щ	*Щ щ*	Shch, shch
К к	*К к*	K, k	Ъ ъ	*Ъ ъ*	"
Л л	*Л л*	L, l	Ы ы	*Ы ы*	Y, y
М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

*ye initially, after vowels, and after ъ, ь; e elsewhere.
When written as ё in Russian, transliterate as yё or ё.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English	Russian	English	Russian	English
sin	sin	sh	sinh	arc sh	$\sinh^{-1}$
cos	cos	ch	cosh	arc ch	$\cosh^{-1}$
tg	tan	th	tanh	arc th	$\tanh^{-1}$
ctg	cot	cth	coth	arc cth	$\coth^{-1}$
sec	sec	sch	sech	arc sch	sech^{-1}
cosec	csc	csch	csch	arc csch	csch^{-1}

Russian	English
rot	curl
lg	log

GRAPHICS DISCLAIMER

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Problems of strength. No. 7 1970.

Page 100.

Scientific-technical conference on the static and dynamic strength of engines. Questions of the strength of engines.
Ye. I. Bopdyrev (Moscow).

Board on the strength of the engines with the scientific council for strength and the plasticity of the AS USSR 10-11 March 1970 led in city of Leningrad scientific-technical conference on the static and dynamic strength of engines. In the work of conference took part of approximately 300 scientists and specialists, the representatives of scientific institutions, VUZ [вузов-Institute of Higher Education] and industrial enterprises of Moscow, Leningrad, Kiev, Novosibirsk, Kuybyshev, Kharkov, Chelyabinsk, Sverdlovsk, Perm' and other cities of the Soviet Union.

Conference opened chairman of board for strength of engines corresponding member of AS USSR E. I. Grigolyuk.

At conference were heard ten reports.

In report of V. V. Bolotin (Moscow) "Some problems of theory of reliability of constructions/designs" is given systematic presentation of theory of reliability of constructions/designs, based on representation of behavior of construction/design in the form of random process, and limiting condition - in the form of ejection from

region of permissible states. The evaluation of reliability is put together of four stages. The first stage is reduced to the schematization of construction/design and external effects on it, i.e., to the selection of the space of effects and state space. The second stage consists of the determination stochastic behavior of construction/design. The third stage consists in the selection of the space of quality and region of the permissible states, which is done on the basis of technical and economic considerations taking into account technological, operational and other requirements. Finally, in the fourth stage (if task carries verifying character) the function of reliability is defined as ones complement of the probability of random ejection beyond the limits of the permissible region.

Finite-dimensional Euclidean spaces are for systems with finite number of degrees of freedom of space of effects, states and quality. Are examined the approximate estimates of the function of the reliability of highly reliable systems, the using mathematical expectations from the number of intersections with the state vector of the boundary of the permissible region. Are given examples of the application of formulas to the evaluation of reliability in the case of the one-dimensional and two-dimensional spaces of quality. Is described the propagation of theory for the distribution of system.

Spaces of external effects, states and quality are treated as function metric spaces. Connection/communication of the tasks of the evaluation of reliability with the distributed systems and the theory

of the ejections of probability fields is considered. Are examined examples of the application of theory to different constructions/designs, in particular, the reliability of vibration-shielding systems with the random vibrations is determined.

A. E. Ugorskiy (Leningrad) in report "Stress-rupture strength of T-shaped tails of turbine blades" presented calculation for prolonged static (upon brittle and ductile fractures) and fatigue strength of T-shaped tails of turbine blades. In the method of design calculation the optimum parameters of the profile/airfoil of T-shaped tails are established/installed. The analysis of stress concentration was carried out with the use of G. Neiber's method to creep conditions. Experiments to the static fatigue strength (upon brittle and ductile fractures) of T-shaped tails and smooth cylindrical samples are carried out with the total duration of all tests 220000 h; the results of experiments are statistically processed.

Report of Yu. A. Samsonov (Leningrad) "About selection of safety factors of parts of power plants from new materials" was dedicated to examination of accelerated method of determining safety factors, which allows rapidly, according to results of testing before decomposition of small quantity of samples with cracks, determine safety factors, which must be accepted during structural design from new unstudied or insufficiently studied materials, penetrated in industry.

In report of V. I. Rosenblum (Leningrad) "Contemporary state and

prospect for development of structural mechanics of turbomachines" are examined experimental-design methods of study of intensity/strength of elements of constructions/designs, calculations of temperature effects, application of computer(s). The successes in the region of simulation are shown. The rational selection of the safety factor for the conditions for high-temperature creep is proposed. New directions in structural mechanics of turbomachines are described.

V. K. Lobanov (Leningrad) in report "About principles of dynamic synthesis of rotor systems GTD [ГТД- gas-turbine engine]" formulates task about identification of parameters of rotor system. He introduces the classification of the solutions on the basis of the account of different character of the interchangeability of the selective solutions, their similarity and difference. On the base of the classification proposed are outlined the stages of the synthesis of the rotor system, which make it possible to systematize the process of the search for the solution and construction, which contribute to the appropriate application of physical laws within the framework of the superimposed limitations.

Page 101.

In report of Ye. I. Molchanov (Moscow) "Thermal stresses in elements of thermopower equipment" are presented, on the basis of practice of operation of thermopower equipment in power engineering, examples of premature decomposition of different elements (rotors, blades and turbine casings; fittings and conduits/manifolds, etc.) as

a result of the cyclic effect of the thermal stresses, which in the majority of the cases appear during the transient thermal conditions. For the thermal-stress analysis it is necessary to know the temperature distribution in the element being investigated with different the regimes/conditions of operation. Not the series/row of examples are shown the results of solving the complex problems of thermal conductivity during the stationary and unsteady thermal conditions. Are examined the worked out methods, which allow on the basis of the experimental data about the thermal metering of the elements of thermopower equipment to obtain either the temperature distribution throughout entire section/cut or to consider the value of heat-transfer coefficient during the unsteady thermal condition.

Is presented calculation of stressed state of rods in elastoplastic region with cyclic variation in temperature according to section/cut and external loads. Are given examples of the calculation of the stressed state in the gas-turbine blades during their warming up and the cooling. Are given also the results of calculating the stressed state in the rotors, the elements of steam admission and the radiation surfaces of heating boiler units. For the evaluation of the strength of the elements of thermopower equipment taking into account the action of thermal stresses the data about the low-cycle fatigue and the stress-rupture strength are used.

Conclusion about need for creation of engineering standard method of calculation of strength of elements of energy thermopower equipment

taking into account action of cyclic thermal stresses is made on the basis of that presented.

Ye. A. Heyn (Leningrad) in report "About simulation of delayed fracture of constructions/designs" as a result of analysis of system of equations of transient creep with static loads and displacements/movements, that includes limiting condition, which determines time to failure, it gives conditions for simulation of delayed fracture.

In report of I. A. Birger (Moscow) "General algorithms of solution of problems of theory of elasticity, plasticity and creep" are examined methods of solution of problems of nonisothermal strain of theory of plasticity and theory of plastic flow. Taking into account the strain of elasticity and creep the general/common algorithm of calculation is reduced to the solution of the problems of the theory of elasticity with variable stiffness constants. The solution of problems is carried out on the basis of the solution of Lame's equation with variable stiffness constants or with the help of the difference equations, obtained by variational method.

In report of B. M. Markov, Ye. B. Lebedeva (Leningrad) "Design of optimum scarf joints of blades of GTD" is examined possibility of designing of standard/normal for scarf joints of turbine rotor blades, which regulates set of dimensions of slot/groove of disk and shank of blade. It is shown that it is possible to select the dimensions of

the slot/groove of disk and shank of the blades, close to the optimum from the point of view of strength for the broad class of engines.

Report of A. S. Vol'shir (Moscow) "Problems of strength of composite materials in constructions/designs of engines of flight vehicles" was dedicated to theoretical and experimental studies of strength, rigidity, stability, durability and behavior in conditions of aggressive media of elements of airframe structures, made from different brands/marks of glass-fiber-reinforced plastic. Is carried out gravimetric analysis of parts from the glass-fiber-reinforced plastic in the comparison with the analogous parts, made from usual structural materials.

In solution, accepted at conference, is noted increased level of research works, calculations and construction in region of engine construction. The considerable successes in the region of the calculated analysis of the strength of constructions with the use of new methods of calculating mathematics and contemporary computer technology are achieved. Are created the modern calculation methods both for the elastic region and for the plastic stage, including creep.

Most actual are acknowledged problems of further increase in specific parameters of engines, their service lives and reliability, improvement of technology of manufacture of assemblies and parts of engines, creation of methods of extrapolational evaluation of strength at high temperatures, especially as a result of action of cyclic stresses/voltages under conditions of nonstationary systems.

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